1980

Effects of water movement and aeration system on the survival and growth of hatchery bred sugpo (Penaeus monodon Fabricius) in earthen nursery ponds

Apud, F. D.

Aquaculture Department, Southeast Asian Fisheries Development Center

Effects of water movement and aeration system on the survival and growth of hatchery bred sugpo (*Penaeus monodon* Fabricius) in earthen nursery ponds

F.D. Apud and A.S. Camacho

An experiment was conducted to determine the effects of water movement and airlift aeration on the survival and growth of *Penaeus monodon* fry reared from P_4P_5 to $P_{32}P_{33}$ in earthen brackishwater ponds. Sixteen 192 m^2 ponds were utilized, complete with reservoir pond, water supply/control/screening and aeration facilities. Four treatments were tested as follows: Treatment A, flow-through 6 hr/day, without aeration; B, flow-through 6 hr/day + 6 hr/day aeration; C, flow-through 3 hr/day + 3 hr/day aeration; and D, flow-through 3 hr/day, without aeration. A dry formula feed containing 54.7% crude protein was given from the second week of culture period at a rate of 20% estimated prawn biomass. The amount was reduced to 10 and 8% by the third and fourth week, respectively.

Higher survival rates were attained in treatments B and C (68.6% and 61.9%, respectively) compared to A (51.6%) and D (46.0%) (Table 1). Survival per pond unit varied from the lowest

Table 1. Percent survival of *P. monodon* fry reared for 28 days, from P_4P_5 to $P_{32}P_{33}$ in earthen nursery ponds using different water management schemes.

Treatments	Replicates (Blocks)				Mean per Treatment
	1	2	3	4	
A	48.6	52.1	59.9	43.8	51.1
B	78.8	59.0	71.7	54.7	68.6
C	54.9	78.7	64.2	49.9	61.9
D	35.9	56.0	60.0	32.1	46.0
Mean Block	54.5	61.4	64.0	47.6	56.9

observed value of 32.1% (treatment D) to the highest value of 78.8%(treatment B). Analysis of variance showed a significant effect of aeration on the survival rate of fry. Although water movement rate had a direct relation on survival, it was not statistically significant. Likewise, no interaction was observed between the two factors.

The final average weight per treatment varied inversely with survival. However, the total yield obtained per treatment was directly related to survival, but differences were not significant (P 0.10). Analysis of variance showed no significant effects of factors A and B to growth with calculated F values of 0.775 and 2.108, respectively. Likewise, no interaction effect was observed between factors A and B to growth with computed F value.

Observed temperature, salinity, mean pH and NH_3 and dissolved oxygen are summarized in Table 2. Temperature varied from a minimum of 27°C to a maximum of 35°C. The lowest (27°C) was observed at 0500 hours in almost all ponds during the first three days of culture period. It appeared that the aeration system had no influence on diurnal changes in temperature, although water movement at 6 hrs daily appeared to cause slightly lower minimum temperature as compared to 3 hours water movement during high tide.

Table 2. Mean maximum water temperature and salinity, pH and NH_3 and dissolved oxygen recorded per treatment during the culture period.

	Temperature °C	Salinity ppt	D.O. ppm	pH	NH_3 (ppm)
A	34.5	38	4.4	7.9	0.021
B	34.7	38	4.7	7.8	0.076
C	34.7	40	4.9	7.8	0.012
D	34.8	40	4.6	7.8	0.096

Observed ranges in salinity (30 to 38 ppt) were within tolerable limits although these were high for best growth and survival of penaeid fry. The relatively higher increase in salinity in treatments C and D could also be attributed to the greater gap between frequency and lesser volume of water exchange as compared to treatments A and B. The frequent water flow did not only prevent higher increase in salinity but also provided water replenishment for losses such as those due to evaporation and seepages. The effect was relatively prominent in treatments A and B with greater rate of exchange as compared to treatments C and D.

pH in this experiment ranged between 7.2 to 8.3. Most observed pH values ranged between 7.6–7.9. This showed that the system virtually helps maintain acceptable pH levels reported for marine culture (Spote, 1970). The frequent flow of alkaline seawater had practically buffered possible reduction in water pH which was influenced by soil pH. In addition, the lime treatment of ponds including the dikes in this study was taken as a precautionary measure against the effects of acid soil condition. It should be noted that the average soil pH during pond preparation was 4.38. However, after lime application this had increased to about 5.81 and was further raised to 7.61 at harvest.

The lowest dissolved oxygen recorded was 3.4 ppm during the first few days of culture period at 0500 hours in treatments A and D. The highest observed level was 12.5 ppm at 1600 hours in treatment B. Higher oxygen levels were observed in treatments B and C although the differences were not so prominent.

The mean ammonia nitrogen concentration ranged from 0 ppm to a maximum of 0.022 ppm. This concentration actually varied from 0 ppm observed frequently in treatments B and C, and at higher concentration of 0.08 ppm in treatment A. The results suggested an inverse relation with survival although no apparent relationship was observed with growth rate.

The final average body weight obtained from each treatment seemed to be inversely related to survival, with 365 mg for B, 393 mg for C, 420 mg for A and 478 mg for D. The good growth and survival rates obtained in this experiment could be attributed to aeration, the use of sheltering materials, abundance of natural food and good predator control. In hatchery tanks the function of aeration is not only to provide adequate oxygen supply or to release toxic gases but also to keep particles of organic nutrients suspended in water (Shigueno, 1975; Cook, 1976). When fry are released in ponds at early stages (P_4P_5) they are known to be incapable of searching for their food, natural or supplemental. This is accomplished in a well circulated or aerated pond, making nutrients and food readily accessible to animals aside from providing adequate oxygen supply and releasing toxic gases.

The relatively higher survival rates obtained in this study justify the need for aeration when using the earliest stages of fry (P_4P_5) at higher stocking densities (100 pcs/m^2). For older stages (P_{16} and above) regardless of source and at lower stocking densities (less than 50 pcs/m^2) nursery operations based on traditional method could also achieve better survival rates.

Literature cited:

Cook, H.L. 1976. Problems in shrimp culture in the South China Sea Region. South China Sea Fish. Dev. Coord. Prog. SCS/76/WP/4: 29 p.

Shigueno, K. 1975. Shrimp culture in Japan. Asso. for Int'l. Tech. Prom. Tokyo. 1-153.

Spote, S.H. 1971. Fish and invertebrate culture. Water management in closed systems. John Wiley and Sons Ltd. 160 p.